

Colour Changes in the Markings on the Surface of the Planet Jupiter.
By E. E. Barnard.

During the twelve years that I have observed *Jupiter* I have often been struck with the decided changes of colour in the different markings on his surface. A careful study of the numerous details during this time has led to the discovery that the red colour of any of the markings is an indication of their age; or, in other words, when a spot or marking (other than the white spots) first appears it is dark or black, but after some time turns red. I have repeatedly predicted to myself this transition upon the appearance of a dark spot, and have yet to find the first instance of a deviation from this striking rule.

As an illustration, I would mention a few cases in my own experience. The remarkable black spots of 1880 which appeared on the northern hemisphere of the planet in October and November of that year were at first black, and then terminated their career by forming a red belt around *Jupiter* (see *Publ. A. S. P.* No. 5).

The small inky-black spots which appeared on the northern edge of the equatorial belt in 1890 soon turned red, and are now almost the reddest objects on the planet.

The new red spot, which lies on a parallel with the southern edge of the great red spot, and follows it by about 140° , when first seen by me in the early part of August 1890, was dark, with no trace of red. It is now the most conspicuous object on the planet, and is of a deep red colour.

There is another marking similar to this in the same latitude, and preceding the great red spot by an hour or so. When first seen this was dusky, with no trace of red. On August 14 last I wrote in my note-book: "This dusky oblong marking has no trace of red now; perhaps it will turn red." It is now of a strong red colour.

I have noted this transformation in a number of other cases. It would, therefore, appear certain that as a rule markings of this class first appear dark, and later turn red.

I have been curious to know if the great red spot in its early history was also governed by this rule. When I first saw it in 1879 it was a deep red, and has been so ever since, except where partially obscured by white clouds, during the past six or seven years. I have fortunately found two early observations of this spot in 1872. These fully prove that the great red spot is no exception to the rule. In the *Observatory* for 1882, vol. v. p. 21, Mr. H. Corder says, in speaking of his observations of this object in 1872, March 13: "Its colour was not noted as red." In the same volume, p. 55, M. Terby confirms Mr. Corder's statement about the absence of colour in the spot. He has an observation 1872, January 28, and, referring to this, says: "I ought

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to say, with Mr. Corder, that I did not remark in this spot. I observed it merely as a dark spot with the same instrument which to-day shows me of this remarkable object in so striking a manner.

From a knowledge of the time occupied by the spots, I think it would be safe to say that the great was not many months old when seen by Mr. Corder in 1872.

This rule seems to apply also to the equatorial belts; darker portions would therefore appear to be new or formations.

Mount Hamilton:
1891 September 30.

*Observations of the Spots and Markings on the Planet Jupiter,
made with the Twelve-inch Equatoreal of the Lick Observatory.
By E. E. Barnard.*

I have already communicated a series of observations and measurements of the markings on the planet *Jupiter* to the Royal Astronomical Society. I have continued these observations this year, and herewith present the results.

The planet has been extremely interesting at this opposition, from the remarkable amount and variety of detail displayed upon his surface. As usual, the two hemispheres have been strongly contrasted in their individual markings. In the southern hemisphere, besides the great red spot, new red spots have appeared, and a great number of round white spots have been visible. These objects are characteristic of the southern hemisphere, though individual white spots have at rare intervals been seen in the northern hemisphere. In the northern half of the planet a system of small dark spots has appeared. These have extraordinary short periods of rotation. The northern regions have also exhibited many features of detail. These have, however, been dark and obscure.

The great red spot has regained much of its former distinctness both in colour and form.

Observations have been made of the relative light and size of the four satellites. These will be continued. The fourth satellite seems to vary considerably in its light.

The following observations and remarks are the result of an examination of the planet with the 12-inch equatoreal of this observatory. The times are Mount Hamilton mean time.

The transits have been obtained by bisecting the equatorial belts by a vertical micrometer wire, and noting when the object passed behind this wire.

In the tabulation of the measures, N means distance from north limb of the planet, and S the reverse.